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LIFE HABITS AND CONTROL OF PINE TIP MOTH:
RESULTS FROM PRELIMINARY STUDIES

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Research by the Forest Insect Laboratory of the Southern Forest Experiment Station is producing information that may improve the efficiency of control spraying for the Nantucket pine tip moth, *Rhyacionia frustrana* (Comstock). This report summarizes two studies made in 1958--one an investigation of the life history of the insect, and the other a test of aerial spraying with chemicals.

Description of Insect

The adult is a small, gaily colored moth about 1/4-inch long, with a wing expanse of 1/2-inch. It is covered with gray scales, and the forewings are marked with W-shaped, reddish-brown lines. Eggs, when first laid, are opaque and whitish, about 1/32-inch in diameter, oval, and flattened. As the egg develops, it changes to a yellowish color, and just before hatching the black head-capsule of the larva can be seen through the thin membrane of the egg cover. The larva, the destructive stage of the insect, is about 1.5 mm. long after hatching and is cream-colored with a black head. It feeds first on the surface of new twigs or within the bases of needles, and later mines out the centers of the twigs. After growing to about 8 mm. in length, it pupates in hollowed-out twigs.

Young shortleaf and loblolly pine plantations throughout the South are attacked. Trees under 15 feet in height are the most susceptible.

There are several generations a year, and repeated attacks kill the terminals, leaving the trees deformed and stunted. The insect spends the winter mostly in the pupal stage, and moths emerge about the time the pines begin their spring growth. To be effective, chemicals must be applied after the adults emerge but before the new larvae become sheltered inside the twigs. Accurate timing of chemical sprays therefore requires knowledge of the life history of the insect.

Life History Study

At Gulfport, Mississippi, newly emerged adults were placed on freshly cut new-growth pine twigs standing in vials of water. Five moths were caged with each of 17 tips. Daily inspections were made for presence of eggs, and new tips were placed in the container when eggs were found. Tips with eggs were checked daily for egg hatching and development of larvae.

Upon emergence (males usually emerged a day or two before the females), the moths often fed on droplets of moisture on the foliage. The first eggs were deposited 1 to 13 days after the moths emerged. The average pre-oviposition period was 6 days in the spring and 3 days during the summer (table 1). Oviposition sometimes continued as long as 15 days. Each female laid an average of 26 eggs.

Table 1. --Development of caged tip moths

Period	Early spring	Summer
	<u>Days</u>	<u>Days</u>
Pre-oviposition		
Minimum	2	1
Maximum	13	6
Mean	6	3
Oviposition		
Minimum	1	1
Maximum	15	8
Mean	3	4
Peak of egg laying after emergence of adults		
Minimum	4	2
Maximum	11	13
Mean	8	4
Incubation of eggs		
Minimum	6	4
Maximum	12	7
Mean	8	5

The eggs usually were laid singly, though as many as four were sometimes observed together. Most were on the needle sheath, in the angle between the fascicle and the stem, but some were scattered on the stem and needles. The incubation period averaged about 8 days in the spring and 5 days during the summer.

After hatching, the larvae wandered over the twigs and needles for up to four hours before they began feeding. Some newly hatched larvae mined just beneath the epidermis of the newly elongated portion of the twigs. In the spring, larvae often bored directly into the

twig or base of a bud; in the summer, most of the young larvae entered needle fascicles and hollowed out the individual needles, later boring into the twig.

In the spring, about 8 days elapsed between emergence of the moths and the period of maximum egg production. If these results are typical, spraying within the week following peak emergence should affect most of the moths before eggs are laid, and may have residual effect on the larvae. To control the young larvae directly, spraying could be delayed for another 8 days, or a total of 16 days after the peak of moth emergence.

Chemical Control Study¹

The study of aerial spraying indicated that a single application of DDT in the spring, at the time of peak emergence of the adult moths, reduces the population long enough for the young pines to accumulate much of their yearly height growth.

The sprayed area was a 400-acre loblolly pine plantation in east Texas. The trees were 3 years old and heavily infested. The tract was divided into eight 50-acre blocks; two 50-acre blocks in a similar plantation a mile away were used as unsprayed checks. The treatments consisted of DDT or chlordane in diesel oil, each applied at 2.5 pounds and 5 pounds of actual toxic ingredient per acre. Each dosage was tested on two blocks. Spraying was done between March 4 and 7, 1958, when it was estimated that 90 percent of the moths were in flight. The plane was a bi-winged Stearman. It was flown about 15 feet above the ground; swath width was 42 feet.

¹ This study was in cooperation with the Southwestern Settlement and Development Corporation, Jasper, Texas.



Figure 1. --Tip moth larvae on stem of pine seedling.

A very high percentage of the moths died within the first hour. Immediately before the spraying, numerous moths could be stirred up by walking through the grass, but within a few minutes after each block was sprayed no moths could be found in flight.

Degree of infestation and height of the pines was measured in February, before the spraying, and again in July and October. As can be noted in tables 2 and 3, 2.5 pounds of DDT per acre were about as effective as 5.0 pounds. Both DDT dosages were superior to either dosage of chlordane. For the entire 1958 growing season, pines on the DDT blocks increased about 1.5 feet in height as compared with 0.8 foot of height growth on the chlordane blocks and about 0.5 foot on the untreated check blocks.

Table 2. --Growth in loblolly pine plantations sprayed aerially with DDT and chlordane for control of the Nantucket tip moth, east Texas, 1958

Active toxicant per acre (pounds)	Average tree height, February	Average growth, February-July	Average growth, July-October	Average tree height, October	Total average growth
- - - - - Feet - - - - -					
DDT					
2.5 lbs. in 2.5 gals. oil	2.72	1.48	-0.03	4.17	1.45
5.0 lbs. in 5.0 gals. oil	2.80	1.46	.04	4.30	1.50
Chlordane					
2.5 lbs. in 2.5 gals. oil	2.63	.89	.0	3.52	.89
5.0 lbs. in 5.0 gals. oil	2.87	.86	-.05	3.68	.81
Check	2.73	.67	-.11	3.29	.56

Nearly all the effective height growth of the trees was made before July; a net loss was recorded on most plots between July and October because new growth during this period was killed back by the insect. Table 3 shows that the percent of infested leaders on DDT blocks jumped from virtually 0 in May to over 50 in July and to nearly 100 by October--an indication that a second spraying might have been worth while.

It must be emphasized that these results do not constitute a recommendation of aerial spraying for the control of the tip moth, but they do supply information on some of the important factors involved. Similar tests are planned for the future, and it is hoped that a firm recommendation will be forthcoming therefrom.

Table 3. --Proportion of pines having leaders infested by tip moth larvae, after aerial application of DDT and chlordane, east Texas, 1958

Active toxicant per acre (pounds)	Pines with infested leaders in--			
	February	May	July	October
	-	-	-	-
	<u>Percent</u>			
DDT				
2.5 lbs. in 2.5 gals. oil	84	2	53	99
5.0 lbs. in 5.0 gals. oil	73	0	60	95
Chlordane				
2.5 lbs. in 2.5 gals. oil	78	26	95	97
5.0 lbs. in 5.0 gals. oil	72	45	97	98
Check	73	(1/)	78	100

1/ No measurement.

